

## CLAIMS

1. A tuneable phase shifter and/or attenuator comprising a waveguide having a channel and a piece of photo-responsive material (18) disposed within the waveguide along an internal wall of said channel, a light source disposed outside the waveguide to emit light through an aperture (30) of said internal wall to impinge on at least part of an outside surface of said piece of photo-responsive material (18).  
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2. The tuneable phase shifter and/or attenuator as in claim 1, wherein the photo-responsive material (18) is a photo-conductive material, e.g. Si, GaAs or Ge.  
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3. The tuneable phase shifter and/or attenuator as in claim 1 or 2 wherein at least the surface of the piece of photo-responsive material facing the aperture is pacified.
4. The tuneable phase shifter and/or attenuator as in claim 15 3, wherein at least the surface of the piece of photo-responsive material facing the aperture has a coating of an epoxy resin.
5. The tuneable phase shifter and/or attenuator as in any one of the preceding claims, wherein at least part of the surface of the piece of photo-responsive material facing the aperture is covered with strips of reflective elements.  
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6. The tuneable phase shifter and/or attenuator as in claim 5, wherein said strips form a grid.
7. A tuneable phase shifter and/or attenuator comprising a waveguide having a channel and a piece of photo-responsive material disposed within the waveguide and spaced from an internal wall of said channel, and a light source to emit light to impinge on at least part of a surface of said piece of photo-responsive material, the light source being adjustable to generate in the piece of photo-responsive material a carrier concentration between  $10^{12} \text{ cm}^{-3}$  and  $10^{16} \text{ cm}^{-3}$ , to modify the real and imaginary part of the dielectric constant of the photo-responsive material whereby at least one mode is generated that has part of its field inside the piece of photo-responsive material and part of its field in the waveguide whereby a phase shifter and/or attenuator that is dependant on the light illumination is generated over a frequency range.  
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8. A tuneable phase shifter and/or attenuator as in claim 7, wherein said carrier concentration is between  $10^{14} \text{ cm}^{-3}$  and  $10^{16} \text{ cm}^{-3}$ .

9. A tuneable phase shifter and/or attenuator as in claim 7 or 8, wherein a said mode is of a first type that has a field intensity inside the photo-responsive material layer that is small relative to the field in the channel outside the photo-responsive material.

5 10. A tuneable phase shifter and/or attenuator as in claim 9, wherein said mode of a first type is  $TE_{20}$ .

10 11. A tuneable phase shifter and/or attenuator as in one of claims 7 to 10, wherein a said mode is of a second type that has a field intensity inside the photo-responsive material that is high relative to the field in the channel outside the photo-responsive material.

12. A tuneable phase shifter and/or attenuator as in claim 7 or 8 wherein a said mode of the second type is  $TE_{10}$  or  $TE_{11}$ .

15 13. A tuneable phase shifter and/or attenuator as in claim 11 or 12, wherein the intensity of the light source is adjustable to place at least one of said modes of the second type in a cut-off state.

14. A tuneable phase shifter and/or attenuator as in any one of the preceding claims, wherein the illumination of the piece of photo-responsive material is carried out at an angle such that total internal reflection occurs.